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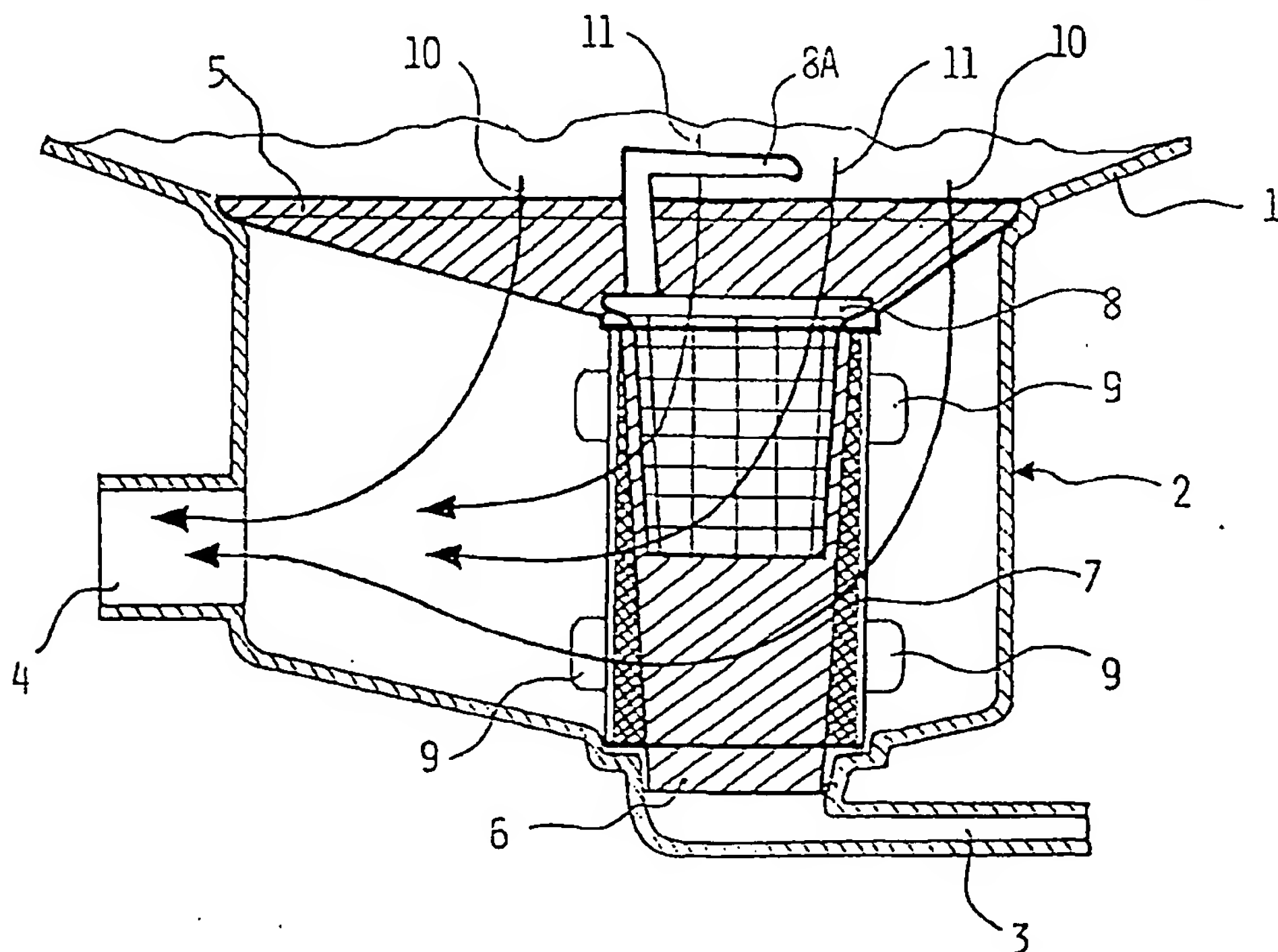
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(54) **Dishwashing machine with improved filtering system, and filtering method thereof**

(57) A dishwashing machine is described comprising a washing tub (1) with a wash-fluid trap (2) secured on its bottom having at least a connecting duct (3,4) to a pump for recirculation or discharge of the wash fluid, said trap being provided with filtering means (5,8) for the fluid to be recirculated or discharged.

According to this invention said filtering means (5,8) comprise at least a first filtering element (7) housed within said trap (2) in a way to allow its angular removal and that said first filtering element (7) is configured so as to allow its angular removal by the force of at least a portion of the fluid flow sucked by said pump.

FIG. 1



## Description

This invention refers to a dishwashing machine of the type described in the preamble of Claim 1.

It is known for modern dishwashing machines to have a tub comprising a wash-fluid trap secured on its bottom. Said fluid trap is connected both with the suction duct of a fluid recirculation pump and a suction duct of a discharge pump.

To ensure machine operation a preset quantity of water is input into the wash tub and said quantity of water is used for the whole wash cycle of the operative programme selected by the user.

Specifically, the wash fluid is forced through the above recirculation pump to some spraying elements located inside the tub, which are used to spray the fluid on the crockery. Once the crockery has been sprayed, the fluid flows back to the tub bottom and is collected into said trap to be recirculated again through said pump. At the end of the wash cycle the recirculation pump stops and the above discharge pump starts operating to discharge the fluid used during the previous step from the tub to a connecting duct of the sewer system or similar.

As described above, it will be apparent how dishwashing machines need a filtering system for the fluid input in the recirculation circuit, to prevent that significant soil particles removed from the crockery may be recirculated again and reduce washing performance or obstruct the recirculating pump. Similarly, filtering means shall be provided to prevent that significant soil particles removed from the crockery or any foreign matter, such as a tooth-picks, may block the discharge pump.

To this purpose it is known for the fluid trap to have a filtering system provided with one or more filters of different size and mesh to obtain the desired purpose of filtering the fluid, which should first be recirculated and then discharged from the machine.

Such a system is known for instance from French patent application FR-A-2.503.557. Such an application describes a filtering system comprising a plurality of filters secured in line with the trap, in particular:

- a first upper filter (fine filter), funnel shaped, with one side configured like a coupling extending downwards to the discharge pump suction duct;
- a second filter (microfilter) surrounding from a certain distance the coupling part of the upper funnel filter;
- a third large-mesh filter (porous filter), tumbler shaped, inserted removably in the coupling side of the funnel-shaped fine filter.

Although such a solution of providing two or more concentric filters for filtering purposes appears to be an efficient one and is widely used, it is anyway connected with some inconvenients.

A first problem is that due partially to the trap configuration and partially to the recirculating pump action the direction of the fluid filtered by the microfilter always flows the same direction, i.e. it is practically always one same part of the microfilter that works on the fluid flow sucked by the recirculation pump.

As a result, soil particles tend to collect mainly in one same area of the microfilter, thus reducing its efficiency and filtering performance.

It is the object of this invention to solve the above problem and provide a dishwashing machine with a more efficient filtering system, which comprises in particular a filter with more areas surely covered by the fluid to be filtered and having a reduced accumulation capacity for soil particles.

According to the present invention this object is obtained by providing a dishwashing machine incorporating the characteristics as per the annexed Claims.

Further characteristics and advantages of the present invention will become apparent from the following description and annexed drawings, which are supplied only by way of explanatory but non limiting example, wherein:

- Fig. 1 shows through a schematic vertical section the lower side of the wash tub of the dishwashing machine according to the present invention during a washing phase;
- Fig. 2 shows schematically a component of the dishwashing machine of Fig. 1, according to a possible embodiment;
- Fig. 3 shows through a schematic vertical section the lower side of the wash tub of the dishwashing machine according to the present invention during fluid discharge phase;
- Fig. 4 shows through a schematic horizontal section the lower side of the wash tub of a dishwashing machine according to a likely embodiment of the present invention during a washing phase.

Some components of the dishwashing machine object of the present invention, which will be mentioned later, are not shown in the figures as being relatively simple and in themselves known.

In Fig. 1 reference number 1 indicates the stainless steel bottom of the wash tub of the dishwasher according to the present invention. The bottom 1 goes further downwards in its central area where a fluid trap 2 is secured to the bottom as normally known. The lower side of the trap 2 houses the suction pipe 3 of a discharge pump, whereas on the side of the trap 2 is located the suction pipe 4 of a recirculation pump.

The trap 2 is covered on its upper part by a fine filter 5 substantially shaped like a funnel with a large opening radius. Said fine filter 5 goes further downwards with its median area inside the trap with a coupling side 6. Said coupling side 6 extends in the illustrated case down to the suction pipe inlet 3 of the discharge pump.

The coupling side 6 of fine filter 5 is surrounded by a tubular filter with a very fine mesh indicated with 7, said filter with very fine mesh 7, or microfilter, whose section is larger with respect to the coupling side 6 and is therefore at a certain distance from it.

As it can be seen, microfilter 7 extends from the top downwards, i.e. from the funnel filter top 5 down to the inlet of suction pipe 3 of the discharge filter. Thus, the microfilter 7 forms a cylindric surface enclosing the coupling side 6 of funnel-shaped fine filter 5.

In the embodiment shown by way of example in Fig. 1, a large mesh tumbler filter 8 with a handle 8A is inserted from the top in a removable way in the coupling side 6 of the funnel filter 5.

According to the present invention the microfilter 7 is not a fixed one as it is usual according to the known state of the art, but is removable under the effect of a fluid flow through the trap 2. This is obtained by two conditions.

On one hand, the outside cylindric surface of microfilter 7 has some protusions, such as protuding blades, indicated by reference number 9 in the figures 2 and 3.

On the other hand, the microfilter 7 is coupled on its upper side according to a known technology to funnel filter 5 in a rotary manner. This can be obtained for instance through a round projection on the lower side of filter 5 and a corresponding seat being slightly larger than the projection on the upper end of microfilter 7.

According to the present invention the dishwashing machine operates as follows.

When the recirculating pump is in operation, the fluid is sucked towards the duct 4 in the direction shown by the arrows of Fig. 1. Most part of said fluid follows the path shown by arrow 10, i.e. through the funnel fine filter 5, which retains the large and fine soil particles from the washing fluid; then said soil particles will go to the coupling side 6 of the filter 5. The tiniest soil particles settle in the suction pipe 3 of the discharge pump whereas the larger ones (eg. a tiny bone) that could cause the discharge pump to be jammed, are retained by the large mesh filter 8.

Another part of the fluid flows to the central area of filter 5, following the path shown by the arrow 11 and flows through the porous mesh filter 8, the coupling side 6 and the microfilter 7. Thus, the larger soil particles are retained by the porous mesh filter 8, the small ones by the coupling side 6 and the tiniest ones by the microfilter 7.

According to the present invention it should be noticed how most recirculation fluid sucked through the duct 4 in the direction shown by the arrows 10 will lap the side of the cylindrical surface of microfilter 7.

Thus, the fluid flow strikes the projections 9 causing the microfilter 7 to rotate as this is not a fixed one as it is usual for the known state of art.

To obtain this result the trap 2 can be favourably configured to cause a sort of internal vortex so that at least a part of the fluid flow sucked towards the suction

duct 4 can surely strike the blades 9 and cause the microfilter 7 to rotate. This concept is illustrated by the schematic section of Fig. 4 using the same reference numbers of Figs. 1 and 2.

As it can be seen from said Fig. 4, the suction duct 4 can be arranged in a nearly tangential position against the main body of trap 2 to obtain the required result. From said figure it can also be noticed how the protusions 9 can favourably be either curved or inclined similar to the blades of a turbine.

Therefore, said rotary motion has the significant result that according to the present invention and in respect to the known state of the art a different section of the microfilter 7 will always appear on the suction branch 4 of the recirculation pump 7 to ensure a higher performance of the dishwasher filtering system.

Another significant result according to the present invention is also the fact that the rotary action of the microfilter 7 favours the removal of soil particles from the surface of the microfilter itself to further improve the system performance, thus acquiring self-cleaning characteristics.

The system performance is further improved by the fact that the rotation of microfilter 7 also causes an eddy effect of the washing fluid in the substantially central area of the filtering system.

As to the discharge of the washing fluid, this occurs when the discharge pump starts operating. The relevant fluid path is indicated by the arrows of Fig. 3.

The fluid portion following the path shown by the arrows 12 causes the tiny soil particles eventually retained on the cylindrical inside wall of microfilter 7 to come off. The small soil particles inside the coupling section 6 of filter 5 are removed partially by the flow 12 and partially by the flow 13. Finally, another portion of the fluid flows centrally according to the arrow 14 to remove the fine particles retained on the upper side of the funnel filter 5 to the suction duct 2 of the discharge pump, through the porous filter bottom 8.

The characteristics and advantages of the dishwashing machine object of the present invention will be apparent from the above description.

Specifically, it is indicated a dishwashing machine with a filter whose motion is obtained by exploiting at least a part of the fluid flow recirculated and/or discharged from the machine. According to a preferred embodiment of the present invention, said filter has a substantially cylindrical configuration and surrounds at a certain distance at least a second filter whose section is also substantially circular or coupling-shaped.

The mobility of the mentioned filter, as said, allows improvement of the overall efficiency of the filtering system, since different parts of the filter are continuously exposed to the flow to be filtered and its motion favours the detachment of soil particles, so that the filter according to the invention acquires selfcleaning characteristics.

Finally it should be underlined how the implemen-

tation costs of the invention are very low, practically equal to the known state of the art and how the size of the various components being used are substantially the same as for the know state of the art.

Obviously many changes can be made to the dishwashing machine described by way of example without departing from the novelty spirit of the innovative idea, and it is also obvious that in practical use of the invention both the materials and configurations of the details illustrated can be different and replaced by other elements technically equivalent.

For instance it will be apparent that the microfilter 7 can be coupled directly to the trap 2 instead of the funnel filter 5, provided that the coupling system selected shall be such to allow an angular or rotary motion of the microfilter 7.

Specifically, the lower side of filter 7 can have a slightly truncated shape and lay in a corresponding flared seat obtained on the duct inlet 3.

It will also be apparent that the number, shape and arrangement of the protusions 9 on the filter 7 can be different from the one shown in the figures.

Finally, it will be apparent that the basic concept of the invention is also applicable to a filter other than the microfilter.

#### Claims

1. A dishwashing machine comprising a washing tub (1) with a wash-fluid trap (2) secured on its bottom said trap having at least a connecting duct (3,4) to a pump for recirculation or discharge of the wash fluid, said trap (2) being provided with filtering means (5,8) for the fluid to be recirculated or discharged, characterized in that said filtering means (5,8) comprise at least a first filtering element (7) bound in said trap (2) in a way to allow its rotation and that such first filtering element (7) is configured in such a way to exploit the force of at least a portion of the fluid flow (10, 11) sucked by said pump for its rotation.
2. A dishwashing machine according to Claim 1, characterized in that said first filtering element (7) has substantially a circular section.
3. A dishwashing machine according to Claim 1, characterized in that the outside surface of said first filtering element (7) has some extending protusions (9), said protusions being in particular either bent or inclined.
4. A dishwashing machine according to Claim 1, characterized in that said trap (2) is configured to favour formation of a kind of fluid vortex inside it.
5. A dishwashing machine according to Claim 1, char-

acterized in that said first filtering element (2) surrounds at least a second filtering element (6).

6. A dishwashing machine according to the previous Claim, characterized in that said first filtering element (7) has a closer-packed mesh in respect to said second filtering element (6).
7. A dishwashing machine according to Claim 1, characterized in that said first filtering element (7) is coupled in its upper section with another filtering element (5) housed within said trap (2).
8. A dishwashing machine according to Claim 1, characterized in that said first filtering element (7) is coupled in its lower section with said trap (2), where the lower section of said first filtering element (7) has substantially a truncated configuration that couples with a corresponding seat obtained in said trap, in line with the inlet of a discharge duct (3).
9. A dishwashing machine according to one or more of the previous Claims, characterized in that said filtering means comprise:
  - a first large diameter filter (5), substantially funnel shaped, covering the upper section of said trap (2);
  - a second filter (6), substantially shaped like a coupling (6) extending between said first filter (5) and a suction duct (3) of a discharge pump, obtained in the lower section of said trap (2);
  - a third filter (8), substantially tumbler shaped and inserted removably within said second filter (6);
  - said first filtering element (7) surrounding said second filter (6) and extending substantially in height between said first filter (5) and the lower section of said trap (2).
10. A filtering method for the washing fluid being recirculated in a dishwashing machine, said dishwasher comprising on the bottom (1) of a washing tub a trap (2) to collect the fluid, where in said trap (2) there is at least a filter (7) substantially of circular section, characterized in that said filter (7) is removably bound in said trap (2) and is subject to rotation by a thrust imparted by a fluid flow (10) through said trap (2), so that said filter (7) is rotated at least during the washing phases through the action of said fluid flow (10).
11. A method according to Claim 10, characterized in that the rotating action determines the exposure of a section of said filter (7) that changes all the time in respect to the flow to be filtered.
12. A method according to Claim 10, characterized in

that the rotating action of said filter (7) causes a force that favours the soil particles to come off from the surface of said filter (7).

13. A method according to Claim 10, characterized in that rotation of said filter (7) causes an eddy effect on the washing fluid in the area of said trap (2) where said filter is housed (7).

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FIG. 1

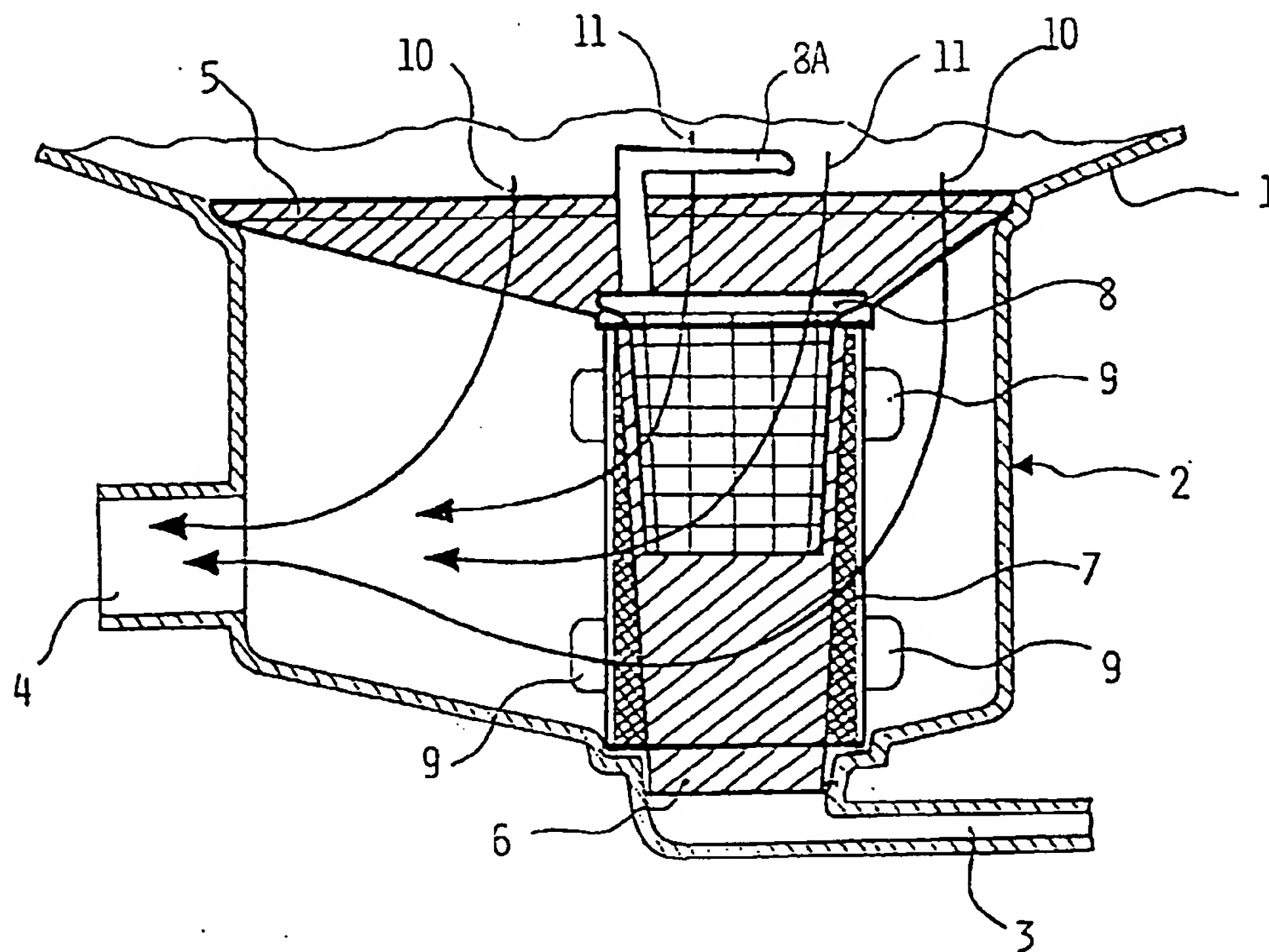


FIG. 2

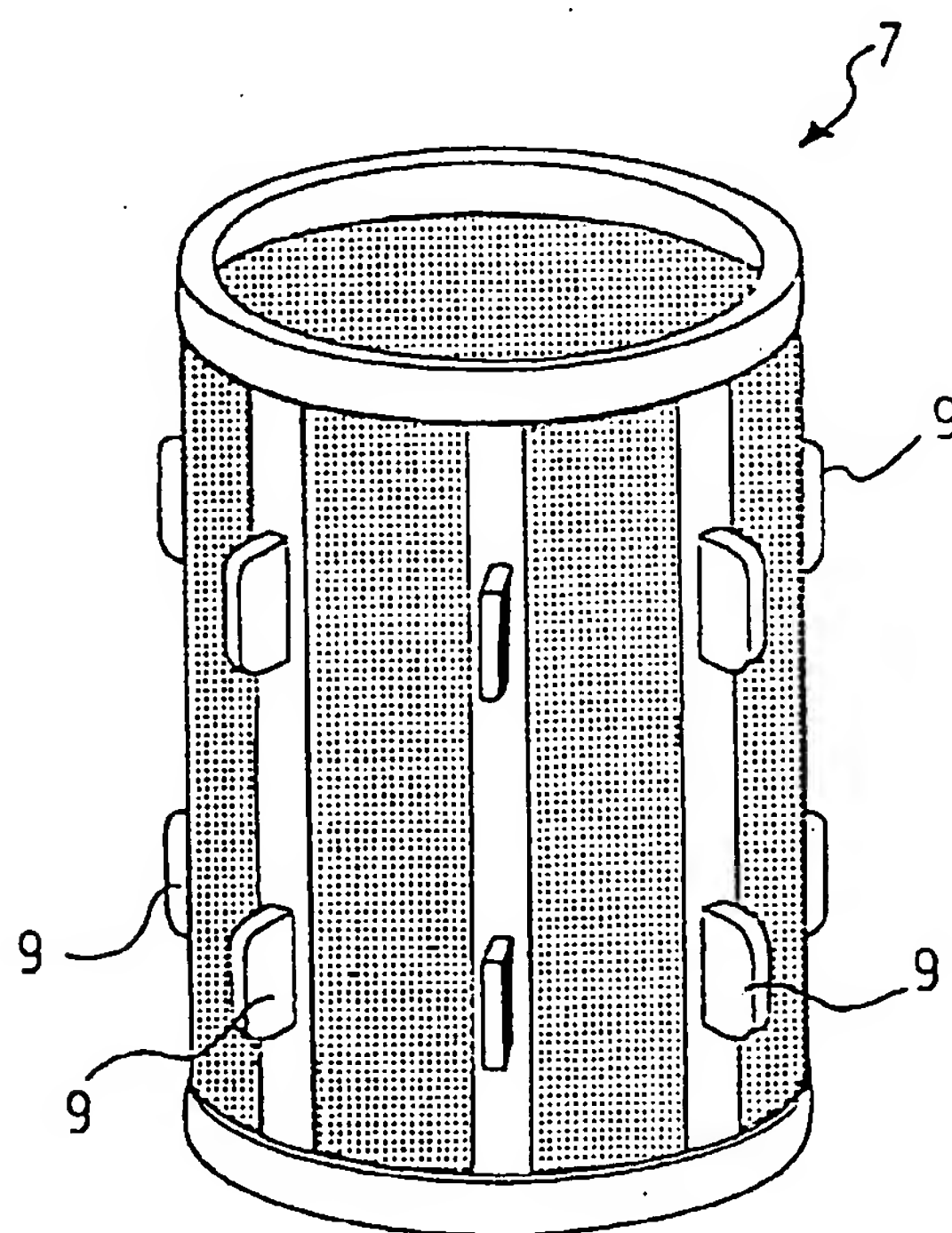


FIG. 3

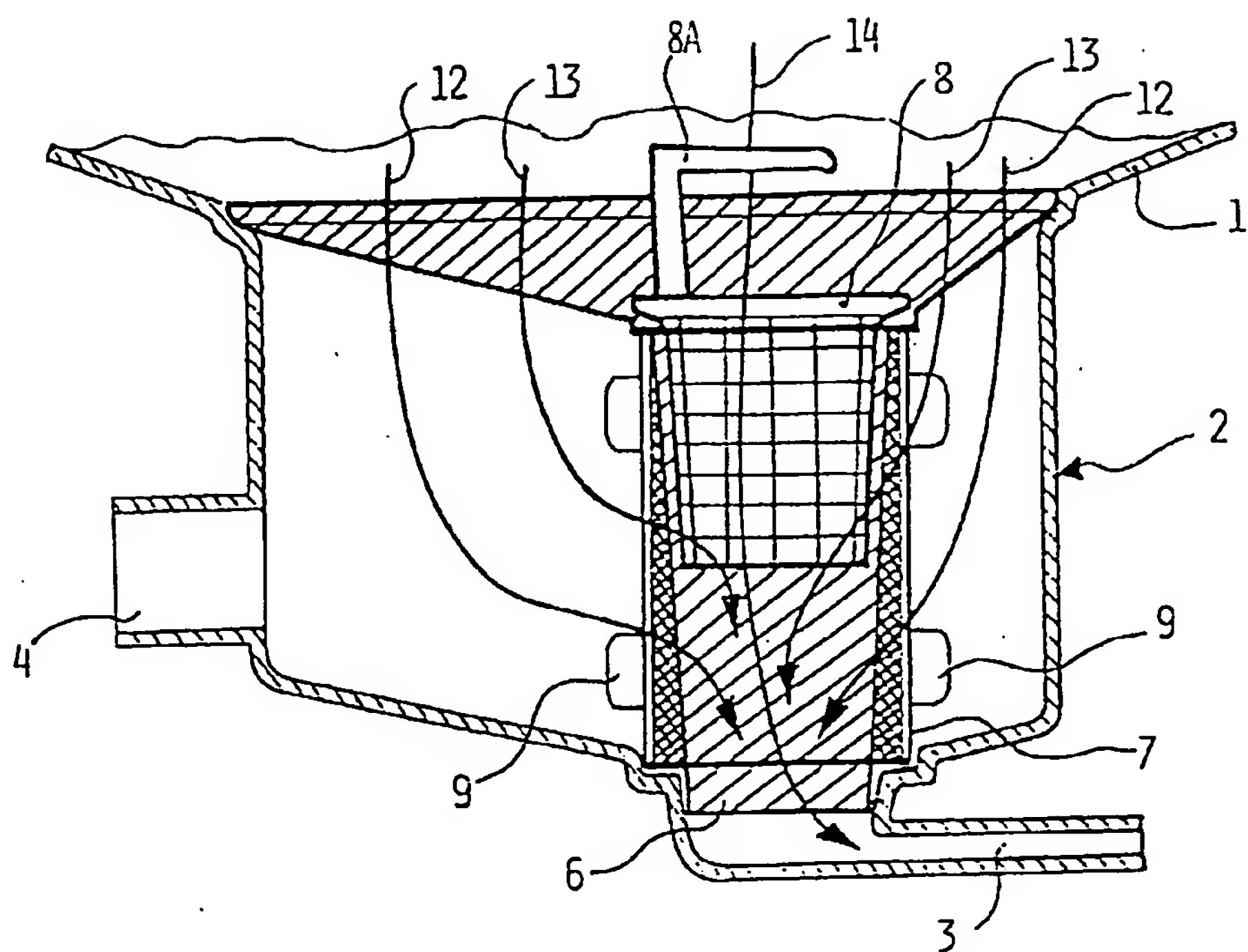
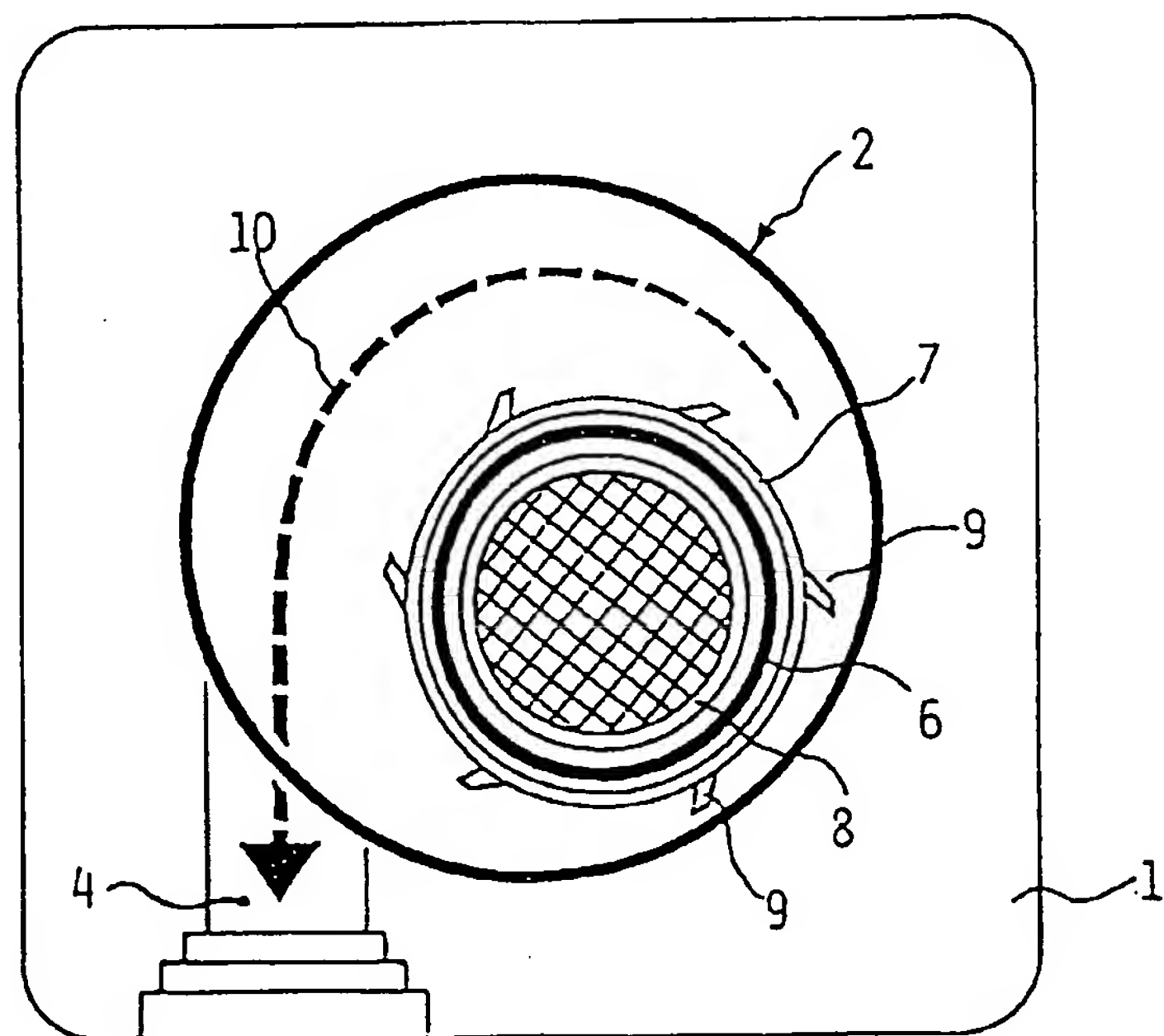


FIG. 4





European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 96 11 0732

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
P,A	DE-C-44 33 842 (BAUKNECHT HAUSGEREATE GMBH) * column 2, line 27 - column 3, line 12; figure 1 *	1,10	A47L15/42
A	DE-A-37 23 721 (CANDY ELETTRODOMESTICI SPA) * column 4, line 45 - column 5; figures 4,5 *	1,10	
A	DE-A-41 31 914 (LICENTIA PATENT-VERWALTUNGS-GMBH) * column 2, line 23 - column 3, line 21; figure 1 *	1,10	
A	FR-A-2 081 286 (ARDAM) * page 1, line 28 - page 2; figures *	1,10	
A	DE-B-11 34 489 (BOELKOW-ENTWICKLUNGEN KG) * column 1, line 48 - column 2, line 38; figures *	1,10	
D,A	GB-A-2 096 456 (BOSCH-SIEMENS HAUSGERAETE) * abstract *	1,10	<div>TECHNICAL FIELDS SEARCHED (Int.Cl.6)</div> A47L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 September 1996	Examiner Vanmol, M
<div>CATEGORY OF CITED DOCUMENTS</div> <div> X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document </div> <div> T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons  &amp; : member of the same patent family, corresponding document </div>			

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